Rate and Placement of Phosphorus for Small Grains

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THROUGHOUT the United States, the phosphorus fertilizer needs of small grains usually are supplied at the time of seeding. Where forage crops also are seeded with small grain, as is common practice in the northern sections, initial fertilization practices are influenced by the need for supplying nutrients to both crops. In these areas, supplemental topdressing of phosphorus and potassium on leguminous meadow, as well as of nitrogen on grass, often is recommended.

A large acreage of fall-seeded small grain is grown in the South. While all phosphorus is supplied at time of seeding, frequently only a portion of the nitrogen is supplied then, with the remainder being topdressed in late winter or early spring. The result is less leaching of nitrogen by winter rains and more efficient use of the applied nitrogen fertilizer.

The possibility of delayed application of phosphorus fertilizer for small grains has received little attention. Such a practice, if feasible, would provide alternative means of fertilization. The added flexibility would be advantageous to fertilizer producers as well as farmers.

In regard to placement of phosphorus fertilizer for small grain, it is commonly observed that band placement near the seed is more effective than broadcast application. Prummel (5), for example, found that band placement of phosphorus 2 cm. from the seed was 2.5 times more effective in Holland than broadcasting. Mattingly and Weddowson (3) found greater percent recovery in England from band-applied P at all stages of growth of barley than from topdressed P.

The purpose of this report is to present the results of a series of field experiments comparing the placement of different sources of phosphate fertilizers compounded into mixtures.

METHODS AND MATERIALS

Two NPK fertilizers (passing a 35-mesh sieve) as sources of P in the field experiments: 10–20–10, P water-soluble, formulated with concentrated superphosphate (CSP), nitrogen solution, H\textsubscript{2}SO\textsubscript{4}, and KCl; and 7–14–14—7% of the P water-soluble, formulated with dicalcium phosphate (\(\text{(NH}_4\text{)}_2\text{SO}_4\)) and KCl. CSP was also included in some experiments.

The fertilizers were applied in three placements: (a) broadcast and disked in before planting, (b) drilled with the seed, and (c) topdressed when the plants were 1 to 2 inches high. The KCl were applied at rates to equalize N at 50 to 80 pounds and K\textsubscript{2}O at 60 to 100 pounds per acre on all plots.

The 13 tests were located on soils testing low in soluble P, with 11 showing yield response to applied P: 2 with summer-grown millet in Georgia and Mississippi; 1 with spring oats in Virginia; and 8 with winter wheat in Mississippi and Virginia. Yields of one clipping of forage were determined on all tests and also yields of grain on a part of each plot of the oat test and a test with wheat in Virginia. Content of P in the forage was determined in the Virginia tests and in two tests with wheat in Mississippi.

In 2 additional experiments in Virginia on Groseclose silt loam in 1959 and Davidson clay loam in 1960, the 7–14–14 fertilizer, diammonium phosphate (DP, 21–54–0, 100% of the P water-soluble), and concentrated superphosphate (CSP, 0–48–0) were compared as sources of P for wheat. All 3 fertilizers were applied with the seed (contact) and in a band 1.5 inches to the side and level with the seed (separate) to supply 40 and 80 pounds of P\textsubscript{2}O\textsubscript{5} per acre. DP was also applied at the rate of 120 pounds of P\textsubscript{3}O\textsubscript{10}. The rate of both N and K\textsubscript{2}O was 80 pounds per acre. Yields and P content of wheat grain were determined.

RESULTS

Forage Yields

No consistent difference was found in the effectiveness of the same amount of P supplied as 7–14–14 or 10–20–10, despite the wide difference in water solubility. Consequently, average relative yields for the two sources of P are given in Table 1. There was considerable variation in water solubility for broadcasting and topdressing among the various experiments. Placement of P\textsubscript{2}O\textsubscript{5} with the seed, however, was significantly better than the other placements in all 11 experiments. Average, broadcasting and disking-in the

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